WATERSHEDS

A watershed is the land area or river basin drained by a river and its tributaries. It can be small --- the creek that drains the school yard, or immense --- the Mississippi that drains the area from the Rockies to the Appalachians, Minnesota to Louisiana (Soil and Water Conservation Service, 1969).

The parts of a watershed include:

- the land area or soil
- surface water
- groundwater

Individual watersheds are bounded by divides or ridges. However, all watersheds are connected to each other as the water flows down one stream and empties into another. Watersheds play a major role in the hydrologic cycle as precipitation is stored in the soil, runs off the surface, and evaporates back to the atmosphere from the surface and plants (Kentucky-Ecuador Partners, 1993).

Surface runoff is water that precipitates or condenses on the earth's surface and collects in nearby waterways such as lakes, streams, ponds, rivers, and wetlands.

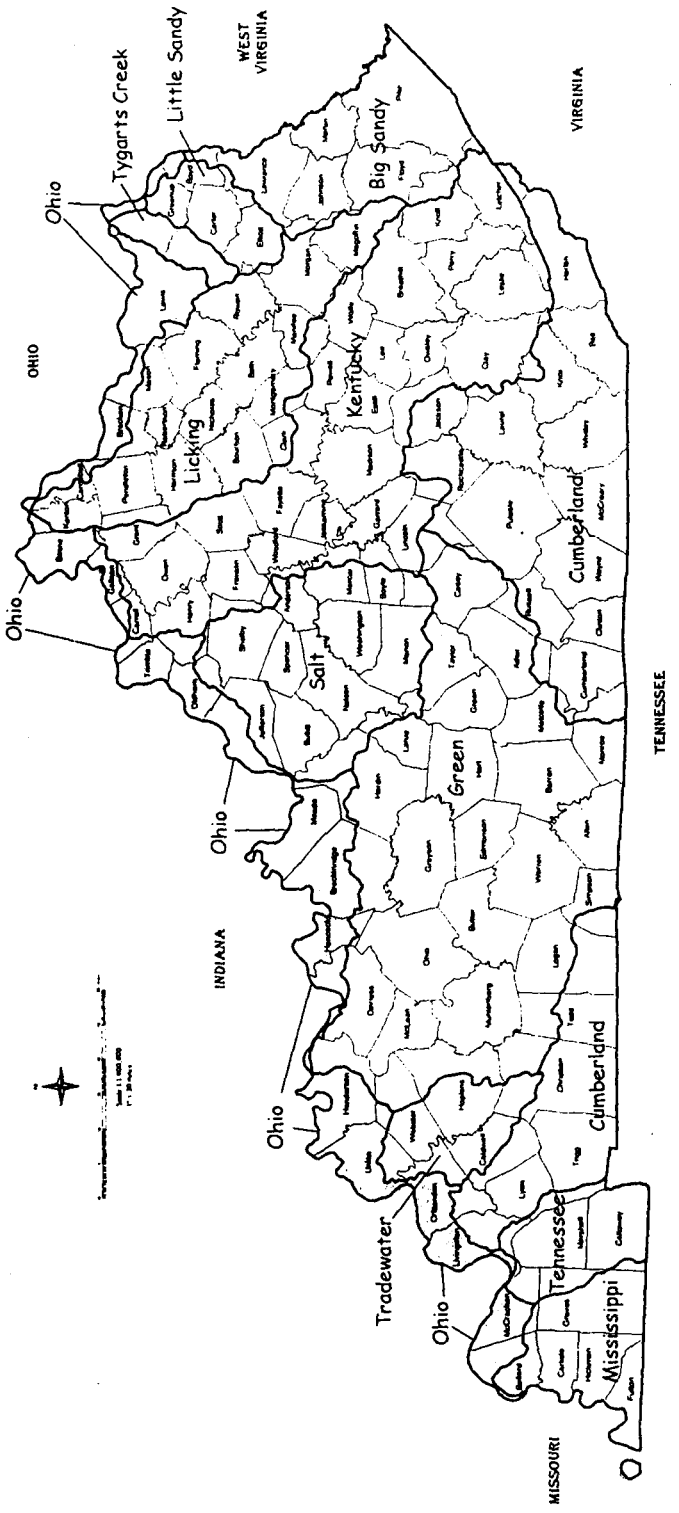
Kentucky is drained by more than 89,000 miles of streams in 13 major watersheds, 2,400 lakes and reservoirs, and approximately 360,000 acres of wetlands. The 13 major watersheds in Kentucky are:

- Big Sandy River
- Little Sandy River
- Upper Cumberland River
- Lower Cumberland River
- Green River
- Kentucky River
- Licking River
- Tradewater River
- Tygarts Creek
- Salt River
- Tennessee River
- Ohio River
- Mississippi River

(Wunsch, Carey, and Dinger, 1993)

The activities in the following sections illustrate the concept of a watershed and how water moves through it.

RIVER BASINS OF KENTUCKY



WHERE IN THE WORLD ARE WE?

GRADES: K-A
SUBJECT: Art, Geography
SKILLS: Comparing, describing, discussing, drawing, inferring, listening, observing, visualizing
DURATION: 30 minutes
SETTING: Outdoors and indoors
KERA ACADEMIC EXPECTATIONS: 1.3, 1.4, 2.3, 2.9, 2.19, 6.3

OBJECTIVE: To gain an understanding of the concept of a watershed and how the community fits into it.

METHOD: Create a pretend watershed then observe a real watershed.

MATERIALS NEEDED:

- Spray bottle filled with water
- Topographic map of area, county map or Kentucky road map
- U.S. map or atlas
- Binoculars (optional)
- Paper
- Crayons, colored pencils, etc.

PROCEDURE:

- Go outside and walk to an area where a stream and its watershed can be easily seen, or visit a park that overlooks a valley.
- Have group stand in a circle, shoulder to shoulder and facing center, leader should be in center.
- Each person cups his/her hands together with fingers together and pointing upwards.
- Hands are now a model of a watershed: fingers are mountains, the spaces between the fingers are valleys, and the palm is the flatland.
- Each person reaches toward center of circle with cupped hands touching hands of persons beside them. Each set of hands represents a small watershed within a larger one.
- Make it "rain" on the fingers with the spray bottle, observe where the water goes.
- Look out over the landscape to see the stream and its watershed.
- Draw a picture of the watershed.
- Locate natural features such as hills, trees, grasslands, etc.
- Locate man-made structures such as roads, buildings, farms, etc.
- Using the maps, follow the stream's course to the Gulf of Mexico. This is your "watershed address." (ex.: Silver Creek to the Kentucky River to the Ohio River to the Mississippi River to the Gulf of Mexico.)

EVALUATION:

- Where did the "rain" go in the cupped hands? (flowed down fingers into the palm)
- Where does the rain go when it falls in the watershed? (flows down ridges to streams)
- Where any man-made structures built in relation to the natural features? (roads on ridges, etc.)
- What could happen to structures built close to stream? (flooding)

(adapted from University of California, 1993)

THE EARTH'S SPONGE

GRADES: 4-A*
SUBJECT: Geography
SKILLS: Analyzing, comparing, describing, discussing, drawing, mapping, observing, predicting, visualizing
DURATION: 2 one-hour sessions
SETTING: Indoors and outdoors, suitable for use in an outdoor classroom
KERA ACADEMIC EXPECTATIONS: 1.3, 1.7, 2.1, 2.2, 2.3, 2.9, 4.2, 5.1, 5.3, 6.2, 6.3

OBJECTIVE: To gain an understanding of the concept of a watershed.

METHOD: Map the school grounds and plot predicted and actual drainage patterns.

MATERIALS NEEDED:

- Small sheets of paper
- Pencils
- Crayons or colored pencils
- One large sheet of paper
- Topographic map of area, county map or Kentucky road map

PROCEDURE:

- Divide class into several groups.
- Assign each group a portion of the school grounds.
- Each group makes a map on small sheet of paper of its portion of school grounds. Include the main building, parking lots, playground, sports fields, open areas, etc.
- Take a walk outside and look for gutters and downspouts on the buildings, gutters and storm drains in the parking lots, gullies and stream channels. Plot these on the map in a different color.
- Predict the paths that the rainwater will take as it runs off the buildings and parking lots. Predict where it will pond. Plot the predictions on the maps in another color.
- Watch where the water drains the next time it rains. Plot these paths in another color if different than predicted paths.
- Combine the information from the different groups and make a map of the entire school grounds on the large sheet of paper.
- Using a topographic map, follow the drainage patterns from the school grounds to the nearest water body.

EVALUATION:
This activity illustrates the concept of a watershed using the school grounds as an example.

- Do the predictions compare with the actual drainage patterns?
- Are there any problems with drainage when it rains, such as ponding or erosion?
- What happens to the litter and oil slicks in the parking lot?
- Where does the storm water go after it leaves the school grounds?

* For grades K-3 take a hike on the school grounds and point out drainage patterns.

(adapted from National Wildlife Federation, 1982)

OTHER RESOURCES

GRADES:

K-A Firehock, Karen, 1994, Classroom Activity #3 - Map a Watershed: Hands-on Save Our Streams, Teacher's Manual, chpt. 1, pp. 22-28.
Make a diagram of a local watershed.

4-8 The Watercourse and Council for Environmental Education, 1995, Just Passing Through: Project WET, pp. 166-170.
Whole body activity - how vegetation affects the movement of water over land surfaces.
_____, Rainy-Day Hike: Project WET, pp. 186-190.
Identify watershed on school grounds and collect data about water flowing over school grounds

4-A Western Regional Environmental Education Council, 1987, Watershed: AQUATIC Project WILD, pp. 163-167.
Measure area of watershed, calculate amount of rainfall it receives each year, and discuss relationship of watershed to human and wildlife habitats.

5-12 Environmental Concern and the Watercourse, 1995, Over Hill and Dale, part II: WOW! The Wonders of Wetlands: p. 220-224.
Make a map of a nearby watershed indicating human-influenced features and activities that affect water quality.

6-8 The Watercourse and Council for Environmental Education, 1995, Branching Out!: Project WET, pp. 129-132.
Build a model landscape to see how water flows through and connects watersheds.

6-A Western Regional Environmental Education Council, 1987, Where Does Water Go After School?: AQUATIC Project WILD, pp. 75-77.
Calculate amount of precipitation falling onto schoolgrounds and trace path of water to nearest body of water.

7-A Lieblich, Suzanne, ed., 1995, Project Part 1 - From the River to the Sea: National Science Teachers Association/DuPont, Understanding Our Environment Series, Water, pp. 30-32.
Select a local stream and trace its course on maps from its source to the ocean.
_____, Project Part 2 - Model of a Local Waterway: National Science Teachers Association/DuPont, Understanding Our Environment Series, Water, p.33.
Use homemade modeling dough to construct a relief model of a local stream from its source to the ocean.

9-A The Watercourse and Council for Environmental Education, 1995, Color Me a Watershed: Project WET, pp. 223-231.
Observe how development can affect a watershed.

WETLANDS

Wetlands are semi-aquatic areas such as marshes, wet meadows, wooded swamps, bogs, seeps, and other transitional zones existing between open water and dry land. In Kentucky, wetlands are found on floodplains, in sinkholes, and along margins of lakes and ponds.

Wetland areas are characterized by:

- saturated soils
- vegetation adapted for life in saturated soil conditions such as arrowhead, water lily, cattail, bald cypress, sedge, rush, and sundew
- flooding or saturation by surface water or groundwater long enough and frequently enough to support vegetation adapted to saturated soil conditions

Within the watershed, wetlands perform important functions including:

- flood reduction
- water filtration and purification
- streambank stabilization
- wildlife and fisheries habitat

(Kentucky Division of Water (b); U.S. Environmental Protection Agency, 1988; Kentucky AField for Kids, 1997).

Wetlands can reduce flooding by temporarily storing storm runoff in its soils. Flood peaks can be reduced by as much as 95 percent because of the volume of floodwater that can be stored in wetlands. Water reentering the stream channel from the wetland flows at a lower velocity which reduces the severity of downstream flooding and erosion.

The vegetation in wetlands is a most efficient water filtration system and improves water quality by removing and retaining excess nutrients, detoxifying chemicals, and reducing the effects of siltation as the sediment load is deposited within its dense root systems. The vegetation also protects shorelines and streambanks against erosion by absorbing and dissipating the energy caused by river currents during floods, and wind/boat-generated waves.

A wide variety of plants and animals, including a number of rare and endangered species, depend upon the wetlands for survival. For some, it's the only place they can live. Freshwater fish, water fowl, and mammals use wetlands for food, reproduction and shelter (U.S. Environmental Protection Agency, 1988).

During Colonial times the U.S. had an estimated 221 million acres of wetlands. Since then, 22 states have lost more than 50 percent of their wetlands because of:

- draining and filling in
- dredging and stream channelization
- diking and damming
- tilling
- overgrazing by livestock
- pollution
- mining

(Dahl and Johnson, 1991; U.S. Environmental Protection Agency, 1988)

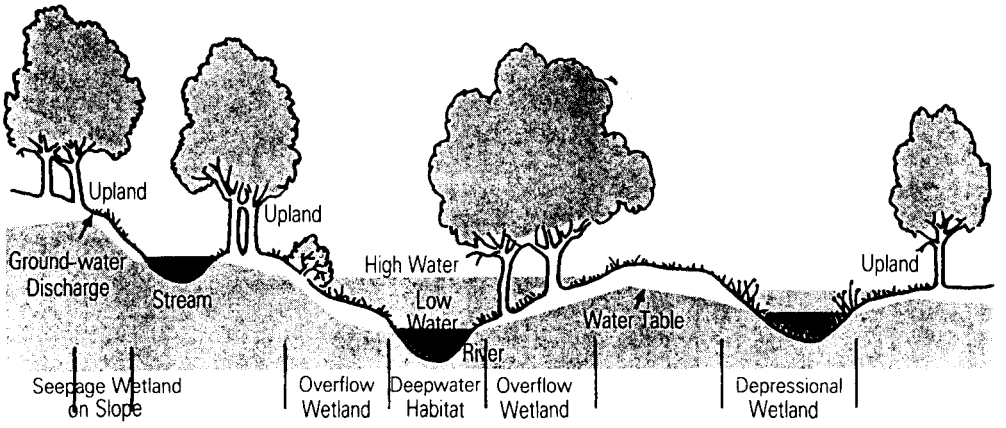
In the mid-1980's only about 103.3 million acres remained. Kentucky has lost about 81 percent of its wetlands and is losing an estimated 3,600 acres of its remaining 360,000 acres annually (Wunsch, Carey, and Dinger, 1993; Dahl and Johnson, 1991).

Kentucky's wetlands are an important natural resource and need to be protected by government regulations and citizen best management practices. These include:

- avoiding the draining and filling of wetlands
- fencing livestock away from wetlands
- selecting upland sites for development
- avoiding wetland alteration or degrading at construction sites
- donating wetlands to public conservation agencies
- maintaining wetlands and adjacent buffer strips as natural areas
- removing waste from sinkholes
- preventing pollution from entering wetlands

(U.S. Environmental Protection Agency, 1988)

TYPES OF WETLANDS



(from U.S. Environmental Protection Agency, 1988)

The following activities illustrate how water moves in wetlands.

LOCATING WETLANDS

GRADES: 6-A*
SUBJECT: Geography
SKILLS: Analyzing, comparing, discussing, map reading, observing, small group work
DURATION: 1 hour
SETTING: Indoors
KERA ACADEMIC EXPECTATIONS: 1.1, 1.2, 2.1, 2.9, 4.2, 5.3, 6.2, 6.3

OBJECTIVE: To be able to identify different types of wetlands.

METHOD: Identify, describe, and locate different types of wetlands on Kentucky maps.

MATERIALS NEEDED PER GROUP:

- Topographic map from any of these counties:

Ballard	Fulton	Jefferson	Ohio
Butler	Graves	Livingston	Simpson
Caldwell	Hancock	Logan	Todd
Carlisle	Henderson	McCreary	Union
Christian	Hickman	Marshall	Warren
Crittenden	Hopkins	Muhlenburg	Webster

- Local county soils map (available from Natural Resources Conservation Service - Soil Conservation Office)
- Worksheet - Locating Kentucky Wetlands
- Pencils

PROCEDURE:

- Divide class into small groups; give each group the materials needed.
- Locate wetlands on each map.
- Fill out Worksheet.

EVALUATION:
This activity illustrates the different types of wetlands in Kentucky and the areas in which wetlands may be found.

- What types of wetlands are shown on the maps?
- What is the most common type of wetland?
- Which part of the state has the most wetlands? Why? (Check atlas of county maps)
- Did any maps show wetlands impacted by development?
- What was the source of the development? (Urban, rural , industrial areas; dams, etc.)
- How could this impact be minimized?
- Are there any wetlands in the local county? Why or why not?

* For Grades K-5 cut out pictures of wetlands from magazines for a display, poster, etc.; get Kentucky travel brochures showing wetland areas and mark the locations on a map.

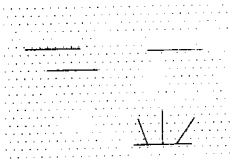
(adapted from National Wildlife Federation, 1982)

WORKSHEET - LOCATING KENTUCKY WETLANDS

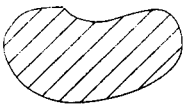
Samples of symbols used on topographic maps to identify the different types of wetlands:

Marsh

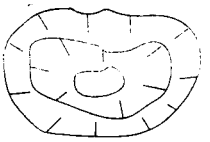
Wooded Marsh - Swamp



Intermittent Lake



Sinkhole



Use the topographic map to answer the following questions:

Name of topographic map. _____

Location of map (eastern, etc. part of KY) _____

How many wetland areas are shown on the map? _____

List the different types of wetlands shown. _____

_____

List the major sources of water that are close to the wetlands. _____

_____

What are the elevations of each wetland? _____

_____

Find other areas of similar elevation on the map. If these areas are not wetlands now, how many could have been wetlands at another time? _____

How many of these areas of similar elevation have been developed? _____

How many wetlands are close to development? _____

How many wetlands have been modified due to development? (look for wetlands with boundaries that are straight lines indicating that part of the wetland has been filled in) _____

_____

(adapted from National Wildlife Federation, 1982)

OTHER RESOURCES

GRADES:

1-A Western Regional Environmental Education Council, 1987, Wetland Metaphors: AQUATIC Project WILD, pp. 49-52.
Use "hands-on" objects as metaphors for the various functions of wetlands.

3-9 Environmental Concern Inc. and The Watercourse, 1995, Soak It Up!: WOW! The Wonders of Wetlands, pp. 162-164.
Increase understanding of how wetlands capture store and release water by using a sponge.

4-5 The Watercourse and Council for Environmental Education, 1995, Capture, Store, and Release: Project WET, pp. 133-135.
Use household objects to simulate how wetlands capture, store, and release water.

6-8 The Watercourse and Council for Environmental Education, 1995, Wetland Soils in Living Color: Project WET, pp. 121-216.
Classify soils according to color to confirm if area is wetlands.

9-A Cole, Charles Andrew, 1996, Wetlands Restoration: Pennsylvania State University, Managing Your Restored Wetland, chpt. 3, pp. 14-21.
Kentucky Division of Water, 1994, Annotated Chronological History of Wetland-Related Legislation and Activities in the Federal Government and Commonwealth of Kentucky: Fact Sheets, 4pp.